Stall Mat Preference in Miniature Horses

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Abstract

Horses spend time in stalls for a variety of reasons which may include practices designed to improve nutrition, breeding and pasture management as well as recovery from injury. With increased stall confinement, bedding materials and rubber mats were added to stalls to improve the absorption of urine and provide insulation and cushion from the stall floor. Although there have been several studies evaluating horse preference for bedding materials, there are no studies evaluating horse preference for stall mats. The objective of this study was to evaluate horse preference and behavior when stalled on rubber mats. To do this, four Miniature Horse geldings (6.5 ± 1.1 yr; 122.8 ± 18.8 kg) were housed individually in adjacent stalls for a period of 16 d. Stalls were bedded with wood shavings and rubber stall mats covering one-half of the stall floor were placed beneath the bedding material. Stall mats were moved to the opposite side of the stall every 2 d. Horse behavior was recorded daily for 4 h during the day (1200 to 1600 h) and 4 h during the night (0000 to 0400 h). Behavior observations were recorded every 5 min during the observation period using a scan sampling technique. Data were analyzed using the GLIMMIX procedure for generalized linear mixed models. Standing and lying behaviors were observed more often when the horses were in the front of the stall, regardless of the location of the rubber stall mat. In contrast, all other behaviors (eating, drinking, defecating, itching and rolling) occurred more often in the back of the stall during the observation periods regardless of the location of the rubber stall mat. Overall, this study suggests that horses do not have a preference for bedded surfaces with stall mats underneath, but rather prefer a specific location in a stall.

Introduction

Horses are often kept in stalls for a variety of reasons which may include practices designed to improve nutrition, breeding and pasture management as well as recovery from injury (Werhahn et al., 2010). With increased stall confinement, rubber mats were introduced to add cushion for the horse's legs as well as allow for a skid-resistant floor and ease of urine trapping and absorbance (Vilem, 1972). In addition, the capture of urine between the mat and bedding allows for the bedding to evenly absorb urine and moisture instead of leaving puddles of urine which can increase the levels of ammonia inside of the barn, leading to possible respiratory disease (Airaksinen et al., 2001).

There are many different types of stall bedding used for horses. The two most common are straw and wood shavings. There are less common types such as newspaper shavings, sawdust, peat, or even coconut husks (Saastamoinen, 2011). These bedding materials are used to absorb urine, moisture and gases. Peat moss is reported as the most absorbent bedding of urine and ammonia while straw and newspaper shavings are noted to eliminate dust (Airaksin et al., 2001). Besides the efficiency of absorbing urine, bedding allows for adequate drainage to keep the bedding from becoming damp and to reduce the amount of dust and ammonia particles in the air (Farm Animal Welfare Advisory Council, 2006). The addition of bedding also allows for a layer of insulation between the floor and the horse, as well as adds a layer of padding to prevent bruising to the hocks and hips while lying (Saastamoinen, 2011). Jonckheer-Sheehy and Houpt (2015) noted that the bedding properties of thermal insulation and padding allow the horse to be more comfortable in their stall. Since lying down is the only time soft tissue has contact with the substrate, it is believed that lying behavior occurs when the preference for bedding is most prevalent (Houpt and Ogilvie-Graham, 2002).

With all the different types of bedding material available for horses, several studies have evaluated if horses prefer one type of bedding over another. Hunter and Houpt (1989) evaluated horse preference for stalls with bedding compared to stalls without bedding. They observed that none of the ponies would lie on the side of the stall without any bedding. When straw bedding was compared to wood shavings, there was less of an overall preference between the two types of bedding. Rather, each pony had an individual preference for the type of bedding. In addition, some ponies showed no preference at all for the type of bedding and instead exhibited a preference to the side of the stall that they were on. Mills et al. (2000) observed similar results in tests comparing paper to straw bedding and paper to wood shavings; however, the authors noted that the horses had a significant preference for straw bedding when compared to wood shavings.

The type of bedding material has also been shown to influence horse behavior. While horses can sleep standing up, they only achieve rapid eye movement (REM) sleep when lying down (Pedersen et al., 2004). Ninomiya et al. (2008) found no differences in standing rest or lying sternal behaviors of horses when kept in stalls bedded with coconut husk, straw, or wood shavings. However, the researchers observed that horses kept in stalls with coconut husk or straw had increased bouts of lying down and increased total duration of lying lateral compared to horses bedded on wood shavings. Werhahn et al. (2010) also observed a longer duration of lying behavior when horses were housed on straw bedding compared to straw pellets. Pedersen et al. (2004) observed that horses housed in stalls bedded with straw exhibited more lying lateral behavior compared to horses bedded on wood shavings. In contrast, Greening et al. (2013) found no differences in standing sleep or recumbent behaviors for horses bedded on straw or wood shavings.

Although several studies have evaluated the influence of bedding material on horse preference and behavior, there are no published studies evaluating a horse's preference for rubber stall mats or their influence on horse behavior. A study using dairy cows reported no differences in total time lying down and the total number of lying bouts per day (Wechsler et al., 2000). Rubber mats often have ridges to help with traction and can be either the size of a stall or interlocking smaller pieces to fit individual stalls. Stall mats are often used to trap urine allowing for it to be better absorbed by the bedding (Saastamoinen, 2011). Stall mats are also thought to help with insulation in conjunction with bedding, allowing for an additional layer between horses and cool floors in the winter (Vilem, 1972). The objective of this study was to determine if horses have a preference for rubber stall mats under bedding material.

Materials and Methods

Animals

Four Miniature Horse geldings (6.5 ± 1.1 yr; 122.8 ± 18.8 kg) were housed individually in adjacent 3.6 x7.3m stalls at The Ohio State University Equine Facility. Horses were fed 0.092% BW/d of a 12% CP pelleted concentrate in the center of the stall and 1.7% BW/d of a mixed grass hay was divided evenly and fed on both ends of the stall. The total ration was divided into two equal meals and horses were fed twice a day at 0700 h and 1630 h. Water was provided *ad libitum* in the center of the stall. Each stall was cleaned daily and shavings were added as needed to maintain a depth of 10 cm.

Experimental Design

Horses were housed individually in adjacent stalls for four 4-d periods. Each stall was bedded with wood shavings at a depth of 10 cm. Wood shavings were used due to the availability

of the material. A 1 cm thick rubber stall mat, covering half of the stall was placed beneath the shavings (Figure 1). The stall wall was marked with tape to identify the transition under wood shavings from stall mat to concrete floors.

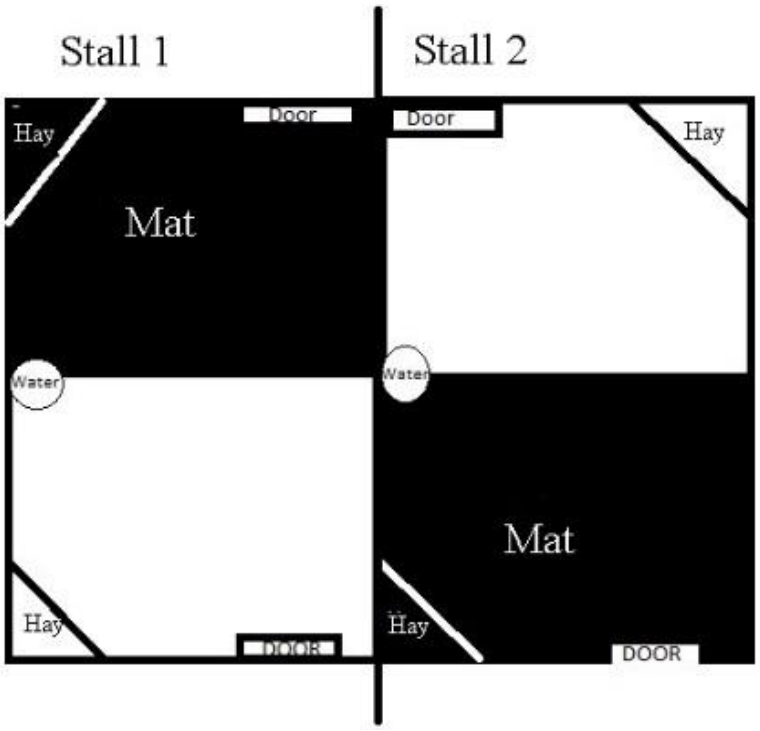

Figure 1. Design and layout of adjacent stalls. Each stall was bedded with 10 cm wood shavings and the mats underneath were 1 cm thick. Hay was equally divided between the hay mangers and water was provided in the center of each stall. Each stall had a door leading to the aisle way and a door leading to the outside.

After two days, the mat was moved to the opposite side of the stall. After the 4 d period, horses were moved to the adjacent stall to reduce variation due to stall differences. Horse behavior was recorded for a total of 8 h each day using a Nuvico CBHD21NL video camera (Nuvico; Englewood, NJ) for 4 h during the day (1200 to 1600 h) and 4 h during the night (0000

to 0400 h). The 4 h periods were chosen to avoid feeding times and allow for observation of a variety of behaviors.

The recordings were played back at a speed of 16x and the location of the behaviors was recorded every 5 min using a scan sampling technique. The behaviors recorded were standing, lying down and other. Other behaviors included eating, drinking, defecating, urinating and itching. These behaviors were mutually exclusive so that a horse standing and drinking would be recorded only as other.

Statistical Analysis

Data were analyzed using the GLIMMIX procedure for generalized linear mixed models (SAS version 9.3; Cary, NC). The least squares mean was reported for each behavior and location along with the standard error of the mean taking into account variance due to horse and period.

Results

Horses were observed for a total of 8 h each day. Horses preferred to stand in the front of the stall regardless of the location of the rubber stall mat (Figure 2). When the rubber mat was located in the front of the stall, horses spent approximately 43.9% of the time standing in the front of the stall compared to 33.7% of the time in the back of the stall ($P < 0.001$). When the rubber mat was located in the back of the stall, horses spent approximately 45.29% of the observation period standing in the front of the stall compared to 41.51% of the time in the back of the stall ($P = 0.07$).

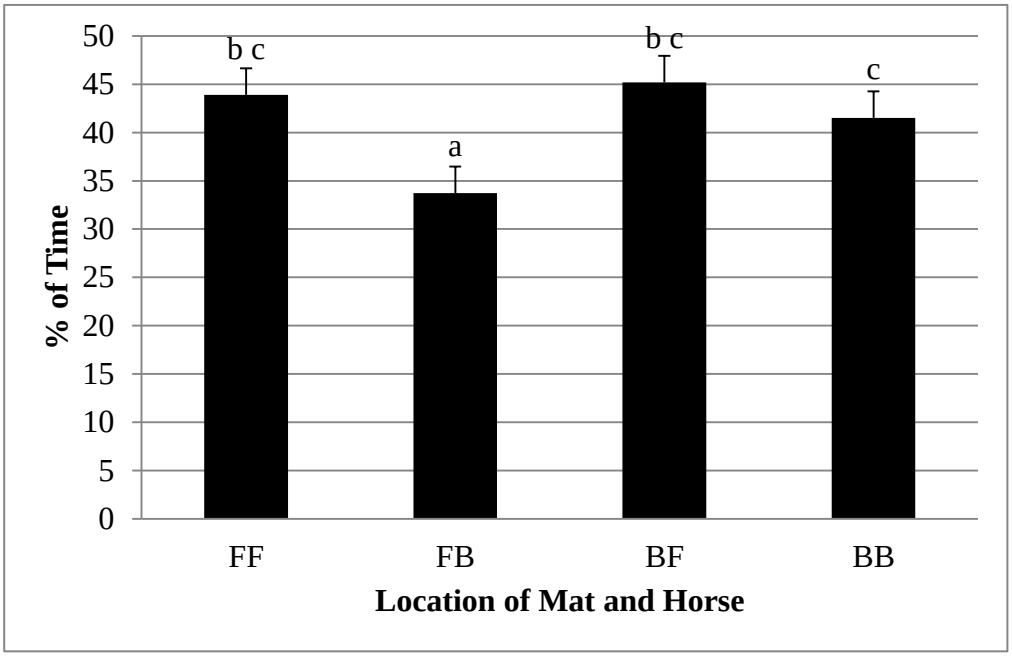

Figure 2. Time budget of standing behavior that took place when mats were located in the front or the back of the stall in relation to the location of the horse when the behavior occurred. Values are represented as means ± standard error. FF = mat located in the front of the stall and the behavior occurred in the front of the stall; FB = mat located in the front of the stall and the behavior occurred in the back of the stall; BF = mat located in the back of the stall and the behavior occurred in the front of the stall; BB = mat located in the back of the stall and the behavior occurred in the back of the stall. Means with no common superscript are different.

Horses preferred to lie down in the front of the stall regardless of the location of the rubber stall mat (Figure 3). When the mat was located in the front of the stall, horses spent approximately 24.87% of the time lying in the front of the stall compared to 21.8% of the time lying in the back (P = 0.10). When the rubber mat was located in the back of the stall, horses spent approximately 19.76% of the time lying in the back of the stall compared to 22.0% of the time lying in the front of the stall (P = 0.14).

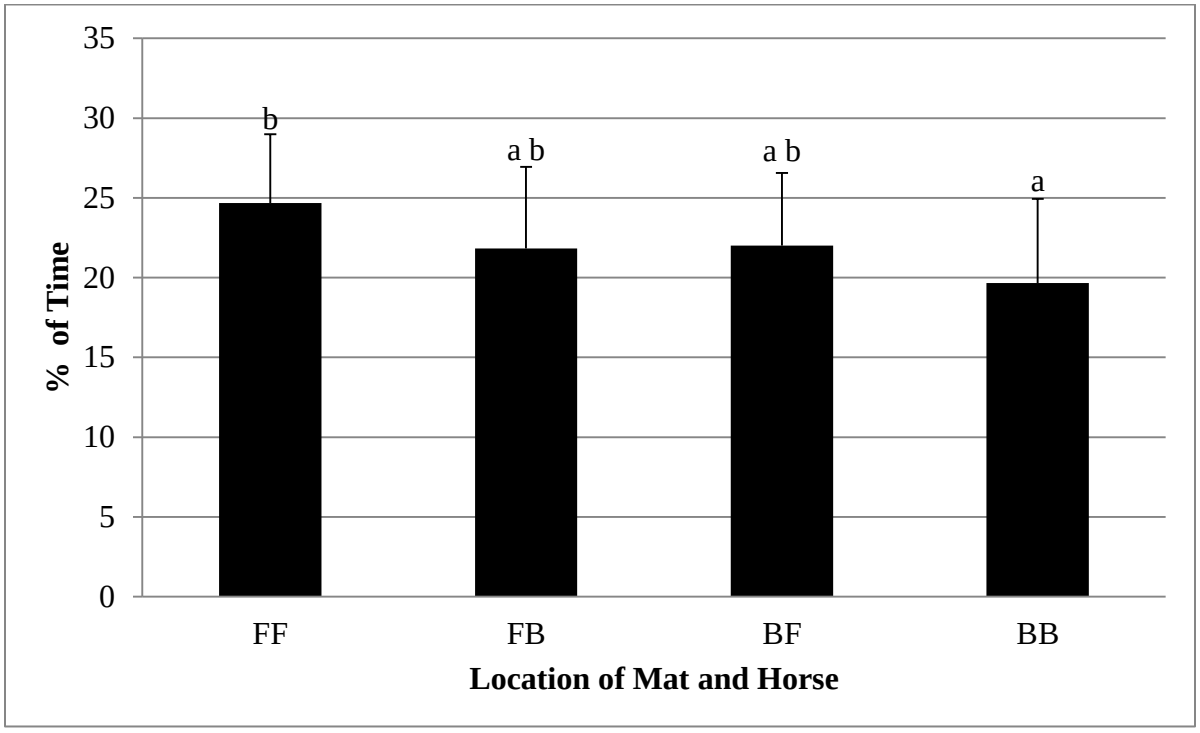

Figure 3. Time budget of lying behavior that took place when mats were located in the front or the back of the stall in relation to the location of the horse when the behavior occurred. Values are represented as means ± standard error. FF = mat located in the front of the stall and the behavior occurred in the front of the stall; FB = mat located in the front of the stall and the behavior occurred in the back of the stall; BF = mat located in the back of the stall and the behavior occurred in the front of the stall; BB = mat located in the back of the stall and the behavior occurred in the back of the stall. Means with no common superscript are different.

All other behaviors (eating, drinking, defecating, itching and rolling) occurred more often in the back of the stall during the observation periods regardless of the location of the rubber stall mat (Figure 4). When the rubber mat was located in the front of the stall, horses spent approximately 31.3% of the time in the front of the stall compared to 44.55% of the time performing other behaviors in the back ($P < 0.001$). When the rubber mat was located in the back of the stall, horses spent approximately 32.8% of the time in the front of the stall compared to 38.8% of the time in the back of the stall ($P < 0.01$).

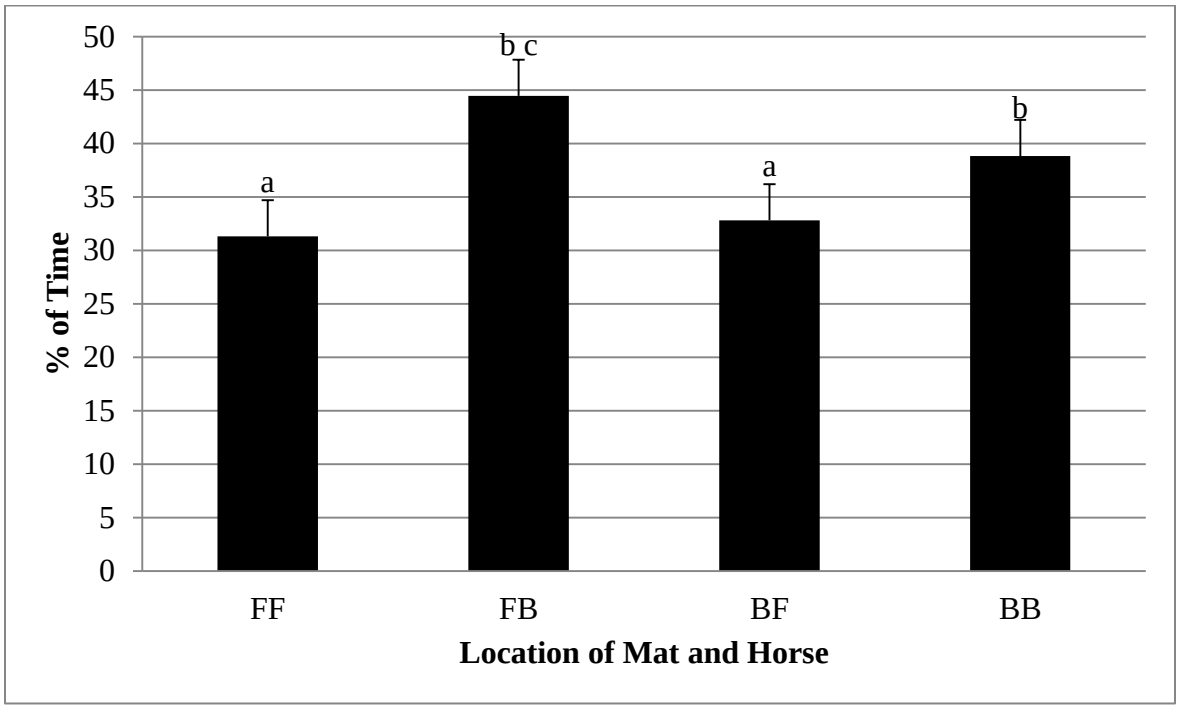

Figure 4. Time budget of other behaviors that took place when mats were located in the front or the back of the stall in relation to the location of the horse when the behavior occurred. Values are represented as means ± standard error. FF = mat located in the front of the stall and the behavior occurred in the front of the stall; FB = mat located in the front of the stall and the behavior occurred in the back of the stall; BF = mat located in the back of the stall and the behavior occurred in the front of the stall; BB = mat located in the back of the stall and the behavior occurred in the back of the stall. Means with no common superscript are different.

Discussion

Rubber stall mats are often used in combination with bedding to help absorb urine and are thought to aid in the comfort of the horse while standing and lying down (Saastamoinen, 2011). A study with dairy cows reported that the use of stall mats allowed for the cows to lie down easily and without any injury compared to a bare floor, and the matted surface was chosen more often for laying down behaviors (Hultgren, 2001). In another study, when cows were given a choice between mats, carpeting, and layered mats, they were observed standing and lying more frequently in stalls where layered mats were used (Natzke et al., 1981).

In the present study, the horses showed no preference for the side of the stall with the rubber mat. Rather, they preferred the front of the stall, regardless of the presence of a mat. These findings are similar to those of Hunter and Houpt (1989), in which ponies had more of a preference for a location in the stall instead of a preference for a specific type of bedding material. Three ponies preferred the right side of the stall and one pony preferred the left side of the stall, regardless of the bedding material.

The predominant behavior observed in the other category was eating hay. With this information, and the time that the recordings took place compared to the feeding schedule, it could be interpreted that the horses preferred to eat the hay from the front manger first after being fed grain, and then would move to the back of the stall to eat hay during the recordings both in the afternoon and at night. Since the horses were fed at 0700 and 1630 h and the recording started at 1200 and 0000 h, 5 and 8 h after feeding, respectively, it is possible that the observation period did not start until the horses had already finished the hay in the front manger.

Multiple studies have reported that horses prefer to lie down for REM sleep between 0000 and 0500 h (Kieper and Keenen, 1980; Hunter and Houpt, 1989; Pedersen et al., 2004). In the present study, horses were observed lying down more often and for longer durations during the night. Between 0000 and 0400 h the horses were observed to lie down approximately 2 to 3 times per night with each bout lasting approximately 1 h. Although horses were observed lying during the day (1200 to 1600 h), the behavior only lasted for short bouts (approximately 25 min) during this observation period.

The horse's preference for the front of the stall, regardless of the location of the mats, may be due to the door to the aisle way located at the front of the stall. This is where the feed was brought in and where people walked by. The door had open partitions so that the horses could see the aisle. The activity may have influenced the horses stand by the door. There was also a door in the back of the stall leading to a turnout pen, but it was kept closed and the horses could not see outside. Having this door open could have influenced the preference between the stall door and the outside door, or it could have created a stronger preference to the back of the stall since it would have been opened.

A possible limitation to this study that may have affected the outcome is the small sample size. In addition, the stalls were adjacent to one another and it was observed that the horses would often stand next to each other on opposite sides of the stall wall. Also, the hallway light was left on throughout the night allowing for light to come in through the stall door. Houpt and Houpt (1988) observed that horses have a preference for light rather than a dark stall and their attraction to light could be attributed to the preference of the horses in this study for the front of the stall. Lastly, environmental factors may have affected the horses' preference for surfaces without the rubber mat. The study took place in June and July and the weather was warm with

high humidity. While there was adequate ventilation within the stalls, a less insulated bedded floor surface closer to the cool concrete might have influenced the horse to choose the stide of the stall without the rubber mat.

Conclusion

Overall, this study suggests that horses do not have a preference for bedded surfaces with stall mats underneath, but rather prefer a specific location in a stall. However, the use of stall mats may still be beneficial to horse management practices due to their ability to trap urine for absorption by bedding material.

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